

FOREST RESOURCES IN *Saskatchewan*



CONSERVATION BULLETIN No. 8

FOREWORD

This bulletin is the eighth of a series, the purpose of which is to describe the natural resources of Saskatchewan and outline sound methods for their management and utilization. The publications are intended to provide those people who are interested in natural resources with specific information of a semi-technical nature. The main consideration in preparing the material is to provide those who are, or may become, community leaders in conservation with a sound basis for formulating opinions on this important subject.

Some of the bulletins will deal mainly with individual species; some with broader aspects of management and harvesting. In all cases they will attempt to convey some knowledge of the lives of plants and animals and their place in the vastly complicated web of nature, for such knowledge is essential to an understanding of conservation. Equally important is a conception of the place of man in the natural scheme of things. Adequate care of natural resources has become the most vitally important aspect of human existence on this increasingly crowded earth, and man may reap well-being only by sowing understanding.

Other bulletins in this series published to date are:

- No. 1 — Beaver in Saskatchewan.
- No. 2 — White-tailed Deer in Saskatchewan.
- No. 3 — Fisheries Research in Saskatchewan.
- No. 4 — Sharp-tailed Grouse in Saskatchewan.
- No. 5 — Fisheries Resources of Saskatchewan.
- No. 6 — Wildlife Research in Saskatchewan.
- No. 7 — Fish of Saskatchewan.

A complete list of publications is available from your local Conservation Officer or from the department offices at Regina.

INTRODUCTION

Most Saskatchewan people make their living directly or indirectly from farming and, by and large, are not fully conscious of the many values of the forests. The Finn, the Norwegian and the Swede treasure their forest wealth above any other national possession, but Saskatchewan people look mainly to the south, to the broad acres of agricultural land. The Germans, and more recently the British, have a widely supported land-use policy which includes the development of national and private forests. Saskatchewan people, on the other hand, demand little of or for the forests.

This situation is natural enough. Many of the prairie pioneers were Ontario people whose parents and grandparents had struggled for two generations to clear the hardwood forests from the farm lands of Southern Ontario. Many other settlers were from the Ukraine, where ownership of arable land was of great importance. Still others were from the prairie states to the south where, by 1900, dry farming was already a generations-old science.

It is true that forest products have not been very significant in Saskatchewan's economy, having contributed a gross production averaging only about \$10 million per annum. Production has varied from year to year, between 30 million and 170 million board feet. Except for a few minor exceptions, manufacturing has

been limited to sawing and planing of lumber.

Within the coming two decades, however, Saskatchewan's annual forest production may easily rise beyond \$100 million. Manufacturing will provide wage employment for thousands of people the year round. Winter logging operations will provide a source of supplementary income for farmers and others whose main work occurs in summer. The timber industry will make its contribution felt also in terms of taxes, purchase of machinery, and payment of operating costs which include food and fuel. The total contribution of the forest industry to the provincial economy will be of major significance. During the same period, increasing thousands of people will utilize the forest region for recreation—fishing, hunting, camping, cottaging, etc.

The approaching period of development will inevitably make great demands on forest administrators, especially those who are concerned with ensuring that the productive capacity of the forests is maintained and increased over the decades and centuries. Forests to be used commercially must be looked upon as a crop in the same way that grain is a crop—except that most agricultural crops take one summer season to mature, whereas forests take 60 to 120 years to fulfill the same cycle of production. The science of silviculture

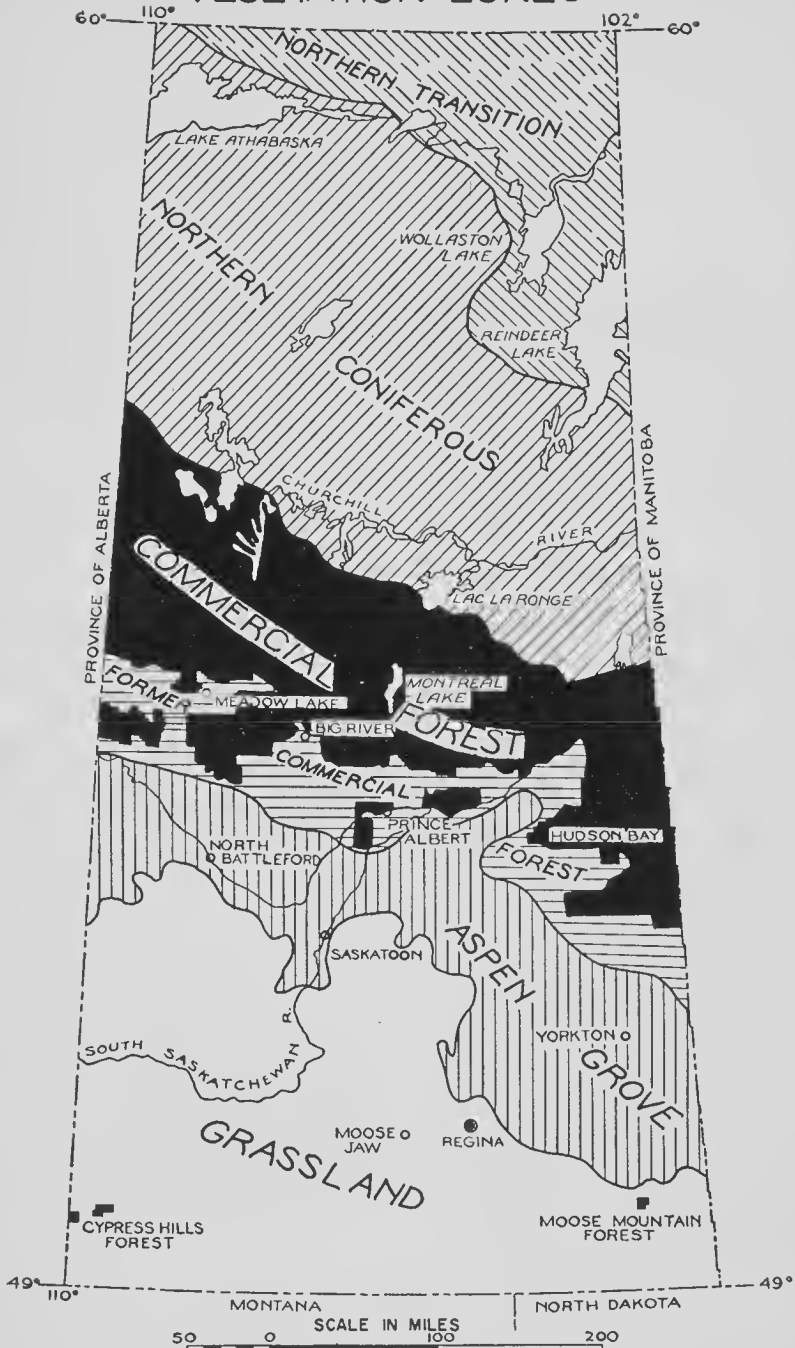
is comparable to the science of agriculture. The future value of Saskatchewan's forests for many generations depends on how fully and wisely this science is applied during the next few decades.

Since most of the taxpaying public lives by agriculture, only a small proportion of the funds spent on forest protection and silviculture are provided by the people of the forest region. However, the money spent on forestry is a sound long-term investment by the people of Saskatchewan. It is pump priming in anticipation of

the day when the forests will pour scores of millions of dollars into the provincial economy, paying back many times over the tax money now being spent on them.

Considering these facts, it seems desirable that Saskatchewan people should begin to learn more about the forests of their province. This bulletin will describe the location and extent of the forests, the vastly complicated system of life within a forest, and briefly mention some of the means whereby foresters may take concrete steps to increase forest productivity.

SASKATCHEWAN VEGETATION ZONES



THE FOREST AREAS

From the highways of the southern half of Saskatchewan and the waterways of the northern half, the traveler can see, in the vegetation growth, evidence of a variety of soil types. Here, a sand bluff rises above the northern lake shore and jackpine raise their ragged, moss-hung plumes. There, a lacy network of slim white birch, limned against a background of gray Precambrian granite, indicates the site of a burn that cleared the moss and duff off the forest floor perhaps half a century ago. Beside a highway, whose ditches are filled with still, brown muskeg water, grow the dense black spruce. High on the benchlands of the north-eastern hills jack pine, aspen, poplar and black spruce compete for place on the moist sandy loam laid down ten thousand years ago by prehistoric Lake Agassiz. Throughout the parklands, scrubby aspen poplar indicates moist, fertile silt or sand loam. In the deep forests south of 56°, tall, straight poplar and white spruce indicate leached grey soil that will grow trees, but little else. Far to the north,

stunted tamarack show the presence of permanently frozen ground—probably grey soil with rocky outcrops. On the prairie to the south, a circle of willow inside a ring of aspen poplar marks a temporary or permanent silt soil slough. A similar slough with only a few scrubby willows near it may indicate the presence of alkali—and so on, past ten thousand soil and topographic variations which, taken as a whole, give Saskatchewan her distinctive and, to the close observer, varied landscape.

The soils of Saskatchewan are predominantly silty or sandy clay loams with considerable local areas of heavy clay and lesser areas of sand and gravel soils. While there is an infinite variety of soil types in any area of a few hundred square miles, Saskatchewan soils can be roughly classified into seven zones. From southwest to northeast they are as follows: brown, dark brown, black, transition (between black and grey), grey, grey rock outcrop and forest tundra transition with rock outcrop.

Area of Saskatchewan—251,700 square miles

Grasslands (Prairie).....	65,350 sq. mi.	Southern Woodlands.....	300 sq. mi.
Aspen Grove (Parklands)....	30,000 sq. mi.	Commercial Forest.....	42,800 sq. mi.
Former Commercial Forest..	15,150 sq. mi.	Northern Coniferous Forest..	86,100 sq. mi.
		Northern Transition Forest..	12,100 sq. mi.
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Area primarily devoted		Area covered by continuous	
to agriculture.....	110,500 sq. mi.	forest.....	141,200 sq. mi.
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Note: Above figures include water areas.

Each area has its distinctive vegetation types, each of which is a product of soil and climate, each of which contributes to the formation of soil, and to a limited degree affects local climate.

TREES OF THE PRAIRIE

The brown and dark brown soil zones are mainly prairie, with fairly low rainfall and little tree cover. However, a vast number of damp low-lying areas, gullies, prairie streams, hill ranges and small sloughs and lakes provide suitable conditions for tree and shrub growth.

The valley of the South Saskatchewan contains a vast number of gullies and small tributaries treed with aspen poplar, a certain amount

of box elder (Manitoba maple), willow, alder, chokecherry and Saskatoon. The flatlands of the valley contain shrub brakes that provide excellent habitat for upland game birds and cover for deer. The poplar-clothed gullies and small valleys provide cover and browse for white-tailed deer, and the shrubby, open slopes and hogbacks are suitable habitat for mule deer and the occasional elk.

The meandering valleys of the prairie streams are bordered by dense growth of box elder, willow, poplar, scrub birch, hawthorne, various smaller shrubs and, in the southwest, broad-leaved and narrow-leaved cottonwoods. These environments are suitable for pheasants, sharp-tailed grouse, white-tailed deer, many species

This tree-fringed slough is typical of tree growth on the prairie.



of smaller birds and animals, and the major predators, coyote, fox, hawk and owl. This tree growth, adjacent to the streams in their sheltered valleys, is especially valuable as winter habitat for deer, sharptails and pheasants.

The small prairie sloughs, almost invariably surrounded by a growth of willow and poplar, provide habitat for sharp-tailed grouse and pheasant, as well as cover for deer in summer.

Within the prairie environment there are a great number of major variations in soil types and topography, such as the Great Sand Hills, the Regina Plains and the Qu'Appelle Valley, Duck Mountain, etc. and consequent variations in

vegetation cover. Within these major variations there are literally tens of thousands of individual minor environments—a small gully here, a shaded brushy slope there, a grey-soil sandy damp spot that produces large poplar, a silt-soil damp spot that produces stunted poplar, a steep, exposed slope facing the sun, with almost no vegetation—and so on through a multitude of variations. The vegetation types in the various environments are not uniform, but they have at least three things in common: they provide shelter and food for most species of prairie wildlife, they diminish the often disastrous effects of a quick spring thaw and water run-off, with consequent erosion, siltation of streams, destruc-

Southern woodlands such as the Cypress Hills are primarily of value for recreation.



tion of fish and lowering of the water table, and they provide pleasant scenery and recreation areas for all citizens. Shelterbelts, increasingly evident all across the prairie, provide similar advantages.

SOUTHERN WOODLANDS

Also within the area commonly referred to as the prairies, are two strikingly different environments, the Cypress Hills and Moose Mountain. Both these hill ranges are timbered, elevated far above the level of the prairie, have considerably higher rainfall than the adjacent areas and, in effect, comprise oases in the sparsely vegetated, relatively dry prairies.

The Cypress Hills consist of steeply-sloping, flat-topped hills, lovely narrow treed valleys, wider valleys with meandering treed water-courses and rolling grazing land. This is one of the most beautiful areas in the whole province, and one that is likely to become a tourist region of some consequence. The trees of the area include lodgepole pine. This is the only area in Saskatchewan where this species is found. Its long, straight boles make excellent building or fence materials and provide the region with a distinctive and valuable timber species. In addition, there are white spruce, white (aspen) poplar, black poplar, willow, Saskatoon, buffaloberry and hawthorne trees, depending on the locality. Most of the northern slopes are heavily clothed with coniferous species which thrive in the absence of extreme sunlight. The damp valleys may contain poplar and spruce, and the multitude of "steps" or small plateaux on the valley slopes provide ideal growing places for lodgepole pine. The trees in the wooded valleys and gullies, together with sagebrush, shrubby cinquefoil

and snowberries, hold the snow in depressions and small ravines, and slow the flow of meltwater down the steep hillsides. This function is vitally necessary in maintaining an even, year-round flow of water in such important streams as Battle Creek.

The Cypress Hills make up a fine winter habitat for a considerable variety of wildlife, including sharp-tailed grouse, elk, beaver, mule deer and white-tailed deer, as well as providing some of the finest winter and summer grazing land in the province.

Moose Mountain is more heavily timbered, but with hardwoods like the poplar species, box elder, green ash, birch, the odd burr oak and a considerable variety of willows and other small shrubs.

The main game animal species include a large population of white-tailed deer, a few dozen moose whose numbers are increasing, and elk in numbers which are increasing to the point where some control is necessary to protect the crops of farmers in adjacent areas.

Like the Cypress Hills, Moose Mountain is a growing recreation area. It is vitally important as a watershed for the surrounding countryside, and provides a considerable amount of small timber for building, fence posts and firewood.

TREES OF THE PARKLANDS

The parklands country is a tremendous black-soil belt between the southern prairie and the area to the north known as the "former commercial forest". The typical tree growth is aspen poplar, which grows in relatively small groves in the western portion of the area and in extensive groves in the eastern portion of the parklands. The only other important species in



Areas such as this one in the aspen parklands provide ideal wildlife habitat.

the parklands is willow, which is found in most moist areas in the region.

This is an area with few running streams and with generally poor drainage. Thus trees play a vitally important role in controlling run-off on the many hills of the rolling countryside, and are probably very important in maintaining water tables. Trees may have an important function in moderating the local climate of any area. Certainly they inhibit the sweep of the wind and reduce the danger of soil drifting.

The parklands groves provide fair habitat for sharp-tailed grouse and superb habitat for white-tailed deer as well as a considerable number of smaller species like the coyote, fox, snowshoe rabbit, hawk, crow, owl and

a considerable variety of small bird species.

The forests and groves of the parklands contain a vast volume of poplar, almost none of which is usable as commercial timber. Aside from providing fence posts and fuel wood, the present commercial value of parkland timber is almost nil, although future possibilities include utilization as fibreboard, craft paper and probably a number of other products that future technology will make possible.

FORMER COMMERCIAL FOREST

Between the Parklands and Commercial Forest is found a region which was formerly clothed with dense white spruce, poplar and jack pine, as well as black spruce in the low-lying areas and some birch and tamarack. Now

almost nothing is left of these forests, for fire and the settler's axe have turned almost every square mile of forest into a square mile of treeless land.

Most of the land cleared in this way was productive farm land, but some forest localities, especially along the forest fringe, might better have been left in timber. In some localities the more advanced thinkers among the farmers are developing managed farm woodlots which will provide a valuable addition to farm income as an expanding forest industry provides additional markets.

THE COMMERCIAL FOREST

North of the cleared forest land is a zone averaging about 150 miles

wide, extending to the 56th parallel of latitude, which contains an estimated 40,000 square miles of timbered land suitable for commercial production.

At one time considerable regions in this area were heavily timbered with white spruce, but fire and heavy lumbering operations, especially during the two World Wars, have almost cleaned out the mature timber. However, a vast volume of wood suitable for a pulp and paper industry remains. It is being protected to the ultimate from fire and opened up by means of a network of access roads. In three or four decades the presently immature white spruce will again begin to provide the basis for an expanded sawtimber industry

A typical view of Saskatchewan's 40,000 square miles of commercial forest.



As yet there is no major commercial use for the tremendous volume of white and black poplar of this region, although a certain amount is being used for plywood at the present time. Undoubtedly in the fairly near future fibreboard and blockboard manufacturing and possibly new pulp-making techniques will increase the value of these species tremendously.

The commercial forest zone is well populated with big game, including deer, moose, elk, woodland caribou and bear, and produces a variety of fur-bearers, including beaver, muskrat, weasel, fox, lynx, marten, fisher, wolverine, coyote and wolf. In the open areas sharp-tailed grouse are found, and spruce grouse are plentiful over much of the region.

The presence of game, a variety of fine fishing lakes, and scenic areas suitable for recreational development, indicates the need for planning for multiple use of this area. Forests have always been most valuable for lumber and pulp, but the less spectacular recreational values will require increased consideration.

THE NORTHERN CONIFEROUS FOREST

The commercial forest extends to the southern edge of the great Precambrian Shield which covers the northern half of the province, and in some localities extends onto the

Shield itself. Beyond is the northern coniferous forest. Its tree species are similar to those of the commercial forest, but with a predominance of tamarack and black spruce. On most of the Shield, however, trees are stunted and sparse, partly because of the cold climate but mainly because of the soil, which is usually muskeg or rock with only a thin surface layer of silt and leaf mould.

Wildlife species are similar to those of the commercial forest, but are less abundant, except for the annual migration of the Barren-ground caribou into this wintering region. This northern coniferous forest will not in the foreseeable future be very important commercially, although it has great value as a habitat for game and fur animals and provides the native people of the region with shelter and firewood.

THE NORTHERN TRANSITION FOREST

This "Land of Little Sticks" begins near the northern boundary of Saskatchewan. The ground here is permanently frozen, thawing to a depth of only about 18 inches during the height of summer. The trees in the area are mainly larch (tamarack), black spruce and stunted birch. None of them have any commercial value, and few other values except for firewood, shelter and game habitat.

THE FOREST--A COMMUNITY OF LIVING THINGS

The average casual observer who visits a forest year after year may note little changes in its general appearance except, over the years, a barely perceptible growth. He may conclude that forests are static collections of trees, interesting mainly because they provide food and shelter for animals.

To the discerning eye of the forester, however, every square rod of a wooded area contains evidence that the forest is a living community, full of the drama of prey and predator, parasite and host, birth and decay,

and the conflict of the weak and strong. The silent struggle for survival, dominance and continuity may take decades or even centuries, but the drama is not less great because of that.

Within the poplar groves throughout the province the struggle for survival is evident. The larger poplars are shading out and killing the smaller saplings. Where the larger trees are not numerous, the shade from their great crowns is not sufficient to inhibit the growth of the saplings, and the big trees aren't close enough

Mistletoe attacking jackpine. Note the so-called "witches' brooms".





Poplar acting as a nurse crop for white spruce which will eventually crowd out the original poplar stand.

together to crowd out the young ones. In a grove like this, the saplings will grow in dense profusion, creating a growth which, as it approaches maturity, will prevent the growth of a new generation of poplar saplings. The poplars in such a grove stand tall, slim and straight, and there is almost no underbrush. No young poplars are rising to take the place of the older trees when they die.

But perhaps a few hundred yards distant from the poplar grove is an ancient spruce, the lone survivor of a forest fire of five decades ago. With the aid of wind, water, birds and animals, this great spruce casts a portion of its seed into the dense growth

of aspen poplar. Most of the seed fails to find suitable soil, being held away from the good earth by a layer of leaves and duff. Such seeds die shortly after germination. Many other seeds are eaten by rodents and birds, but one seed in 100, or 1,000 finds a moist, fertile growing spot, and in a few years the dense poplar stand is sprinkled with spruce seedlings and saplings. The white spruce is shade-enduring, so its saplings survive and grow tall toward the sunlight. Within six or seven decades the spruce will be as tall as the poplars, and will be competing with them for living space, water and sunlight. The less vigorous of the aging poplars die, and the spruce, freed from their competition,

grow even faster, using even more water and sunlight until one by one the old poplars die and rot away, leaving a small legacy of leaf-mold and duff for the nourishment of their successors. Under some conditions, it may take only 70 or 100 years for a poplar stand to be replaced entirely by the long-lived, shade-enduring conifer species.

Elsewhere in the forest area, jack pine are under attack by another hardy plant, the mistletoe, which grows as a parasite on the pine, using the life-giving sap, much as ticks suck the life-blood from a moose, weakening the trees and permitting disease to get a foothold. The great "witches' brooms" of mistletoe, growing from the branches of the jack pine, are evidence of the battle. The result may be the death of the pine forest and an almost inevitable fire that will find good going in the dry, resinous branches. The fire will purify the area by destroying parasite and host as well, while not harming the seeds necessary for a new generation of pine.

Individual trees of all species must face various insects and diseases, and either withstand the attacks or perish. A healthy tree, with adequate growing space, sunlight and moisture, can usually survive, whereas a tree without all these advantages may gradually lose the struggle. Fungus may rot the heart out of a weakling tree while a neighbouring tree which, for some reason, has a little more vitality will live out its full span of years. Woodpeckers or parasitic insects may help weak trees by destroying a portion of the insects that prey on them.

Dozens of examples similar to the above could be given to illustrate that the fight for survival is an im-

portant and continuous factor in the community of trees. And intimately connected with this fight are animals, birds and insects of an area. Birds like the nuthatch live on insect eggs and larvae, making their living by protecting the trees. Spruce budworms, army worms and larch sawfly occasionally become epidemic in an area, for some reason not yet fully understood, and create havoc among the species of trees on which they feed. Saskatchewan's most serious epidemic to date has been the successive infestations of larch sawfly that have practically wiped out the tamarack of the commercial forest region.

Except for girdling of saplings by rabbits and the distribution of conifer seeds by squirrels, the effect of wildlife on forests is not great. Porcupines may girdle and kill the odd tree. Moose may browse and prune young trees excessively in limited local areas. Mice may destroy seed and tiny seedlings, and beaver, of course, utilize trees (mainly poplar) as food and destroy a fair amount by flooding it out. But the total effect of all these causes is not of great significance. Beaver, of course, may create a series of ponds along a forest stream, creating an excellent strategic location to build a "fire-line" against a forest fire which might otherwise be much more difficult to control. On the other hand, when beaver desert an area and the dams wash out, the resultant area of tall grass, dry brush and deadfall trees may be a serious fire hazard. Forests have a profound effect on wildlife, however, and the protection and management of the commercial forest may have far-reaching consequences to wild game.

Fire especially is important to wildlife. Immediately after a bad fire,



An aerial view of the forest on the Precambrian Shield illustrates the variation in tree size and species.

game may be scarce in the burned area, but for two or three decades thereafter a burn will support great numbers of animals and birds. During the first three or four years after a fire, burns support sharp-tailed grouse, striped gophers (13-lined spermophiles), mice, and certain small birds, together with such predators as foxes, owls, skunks, coyotes, weasels and hawks. After about the fourth year, the poplar, jack pine, Saskatoon, pincherry, chokecherry and other small trees and shrubs are large enough to support ground squirrels, deer, moose, elk, bear, rabbits, and indirectly, wolves as well as most of the other species previously men-

tioned. This period of game abundance may continue almost uninterrupted for 30 years, until the poplar reaches its pole stage. It is then out of reach of deer and moose, and has shaded out or crowded out much of the smaller shrubs. As the poplar reaches its third or fourth decade, spruce seedlings will probably be seen growing toward the sun, and as the poplar becomes decadent the spruce eventually achieves dominance in the forest. During the last three or four decades of a poplar forest's life, game remains in evidence, but in decreasing numbers. As the spruce gradually matures into a heavy, dense stand, only the red squirrel, pine marten, fisher,

porcupine, spruce hen and woodland caribou survive within its gloomy, shrubless depths. As long as coniferous trees remained dominant in a particular forest area, wildlife remains scarce.

These are only a few examples of the inter-action of the living things in a hundred thousand Saskatchewan groves. Our forests are diverse and complex—a fact which is never more apparent than when they are observed from the air in the fall of the year. Here, underneath the wingtip for five minutes of flying, is the flaming golden-yellow of a solid aspen poplar grove; there, between a small muskeg and a smaller lake, the deep green-blue of the moisture-loving black spruce forms a dense mat; beyond is a jack pine ridge, sparsely wooded

and maintaining a fine stand of hard grass where the elk will find winter grazing; and further on is a solid grove of majestic, mature white spruce, three feet at the butt and 120 feet tall. Thus the forest changes in appearance and makeup, with seldom a solid 20 mile extent of uniform timber in the whole 40,000 square mile commercial forest zone.

Even the apparently uniform timber stands are not really uniform at all when viewed by the discerning eye of the forester. All through a plot of poplar the larger trees are shading out and killing the smaller trees, the weak and diseased are being gradually deprived of water and destroyed by the vigorous root systems of adjoining healthy trees, and in the under-story are spruce saplings that will in

On the Precambrian Shield, trees can be found apparently growing in solid rock.



five or six decades break through the canopy of poplar crowns and in turn destroy the aging poplar.

The soil itself is not uniform. At one point there may be a sandy, fairly dry, well aerated spot where jack pine find excellent conditions, and not far distant a white spruce grove on moist soil. Beyond, in a muskeg area, the soil is airless, water-saturated and acid, and the white spruce are spindly and unthrifty in comparison to the well-developed black spruce.

The forests are not uniform, nor are they static and passive. The struggle for food, air, sun, and living room goes on in the forest as it does in any community of living beings. In an apparently uniform forest, each tree is an individual, carrying on a decades-long fight for survival against insects, disease, climate, various animals and neighboring trees of similar and different species. Yet while carrying on this struggle, the tree contributes in one way or another to the survival of the whole community of plants and animals. And during its life and death, it contributes to the soil that will nurture future generations.

HOW THE FORESTS GROW

There are many areas of forest land in Saskatchewan which are underlain by rock, with only a thin layer of soil to provide sustenance to the plants. When such an area is burned over, almost all of the soil is destroyed. Then the area is practically a desert. However, nature has her own means of rejuvenating an area. In a case of this kind, the agent is usually birch saplings, which spring up in the sterile burn, grow into spindly saplings, and then die, leaving a tiny contribution of rotting leaves and

wood. Eventually, after generations of sapling birches have built a perceptible layer of mould and duff, aspen appears on the scene, providing a larger growth of wood and denser growth of leaves, and building soil faster and faster, until finally a few balsam and spruce show up and eventually replace the hardwoods, which are less shade-enduring than the coniferous species.

In areas of solid rock, it seems impossible that trees could find sustenance, but once again nature pulls a trick out of her hat. The slender roots of the jack pine cling to the surface of the rock and penetrate into every small crack and crevice. Irregularities in the rock may catch rain water, crevices may provide further reservoirs, and when the atmosphere is humid in early morning and the rock is cold, condensation takes place inside the cracks and crevices, providing still further supplies of water. But where does the nourishment come from, when there is no soil? The answer is in certain fungi which live in the root systems of jack pine. They depend on the tree for sustenance, and in turn create nutrients for the jack pine by acting chemically on the minerals of which the rock is composed.

Some trees also present marvelous examples of adaptation to various environments. Most trees require aerated soil for good growth. Trees like white spruce or alder may survive if their roots are surrounded by water, but only if the water contains oxygen. Thus, white spruce may be seen along the shores of lakes, where wave action continually dissolves oxygen in the water. But with its roots in stagnant water for any length of time, the white spruce will die. Black spruce, on



Jack pine regeneration after a fire.

the other hand, does very well in stagnant water and acid muskegs. Without black spruce, much of Saskatchewan's present forest area would be deserted, treeless moorland, rather than forest capable of yielding vast supplies of valuable pulpwood.

Jack pine, too, has an almost miraculous means of ensuring its own survival on upland sites. A stand of pine may produce millions of cones containing hundreds of millions of seeds over the years, but relatively few of these germinate. The stand is usually made up of a single age group. This is true of nearly every one of the 1.6 million acres of jack pine in the province. The forest floor in such stands contains few jack pine seedlings.

If a fire should occur, totally destroying a jack pine stand, a minor miracle occurs: millions of seedlings begin to rise, like the Phoenix, out of the ashes of their forebearers. The tight cone of the jack pine normally keeps the seeds from contact with the soil, but when subjected to a hot burn, the cone is weakened or cracked and the seed may then germinate if moisture and soil conditions are favourable. Because the seeds withstand extreme heat, jack pine, under natural conditions and repeated burns, may remain for hundreds or thousands of years as a major occupant of any area of sandy land. The pine has a normal life expectancy of 100 to 150 years. Since Saskatchewan's forests have seldom escaped fire for such a length



A typical black spruce stand in a muskeg area.

of time, jack pine forests have remained the dominant tree species over considerable areas.

Soil, of course, is one of the main factors in all growth. The soil type and topography have a profound effect on the type of forest cover which may be expected, although other factors like climate, fire, insects and disease also govern to some extent the type of trees in any area. There are literally dozens of different forest soils: aeolian (windblown) sands, stony or gravelly locations, beach sands, peat soils, leached sands (podzol or grey wooded soil), leached loams, lake-bottom clays, leached (podzolized) clays, stream-bottom soils, black muck soils and 30 or more other definite soil types, each of

which has a definite influence on forest growth and cover type. A beach ridge of sandy clay high up on the Porcupine Hills, deposited by a glacial lake 15,000 years ago and worked over by water and a thousand generations of growing vegetation, may provide a small, specialized environment where black spruce thrive. An esker of sand and gravel, left by one of the thousands of rivers flowing southward over the glaciers, enriched by leaf mold, may provide satisfactory conditions for white spruce. A particular bog, where the type of water is changed by seepage, may also permit the growth of white spruce. Another bog just a few yards distant, with stagnant water, may be suitable only for black spruce and tamarack. A

certain section of sand country may be continually on the move, duned up by the wind long enough for light vegetation to establish, but shifted away before significant tree growth can occur. Another area of sand almost identical in appearance may contain some tiny component of gravel or clay that binds it enough for jack pine to take root and begin the centuries-long task of soil development that one day may turn it into a grey podzol soil capable of supporting hardwoods or even spruce.

Soils build forests, and in turn forests build soil—and by burning, occasionally destroy the soil. There are probably a thousand or more areas, large and small, of distinctive soil types in the forests of Saskatchewan. Within each of these nearly uniform areas are smaller localities with different characteristics, which produce differently in terms of tree growth.

While the soil type tends to govern the forest cover, many accidents of nature can alter the picture for centuries or even aeons of time. For example, suppose a fine white spruce stand is growing on good decomposed peat soil, with a layer of heavy soil two or three feet down. As the over-mature spruce die, seedlings are available to replace them. The forest is heavily populated with squirrels for miles around. Then suppose a light burn occurs, killing ten or twenty square miles of this forest and leaving a dense stand of dead and damaged timber which shades the area and prevents the windborne seeds of poplar from establishing new hardwood forest. The squirrels from the adjoining unburned forest carry spruce cones into the burned area, finding good storage facilities in the rotting

timber, and within ten or more years, the forest is re-seeded to spruce. But suppose that, about the year of the burn, a migration of pine martens had cleaned the squirrels out of the country, as happens occasionally. The dead timber would then eventually rot, fall to the ground and be succeeded by a dense growth of poplar, which would dominate the area for 70 or 100 years, with even then perhaps only a sparse sampling of spruce saplings making their bid for eventual dominance of the area.

Suppose on the other hand that a similar stand of white spruce were burned severely in a dry year, so that much of the peat soil was destroyed. If the local climate happened to remain dry for a few years, willow and poplar would have become established and begun their soil-building process. They would prevent extensive surface run-off during storms and spring thaws, and build a poplar forest which would probably be replaced in one or two generations by white spruce. But if a wet season occurred before the poplar became established, the snows would melt quickly in the spring, with no shade to slow the melting process and the meltwater and rain would not be held by a layer of leaves and duff. All the low spots would become ponds or small lakes and would remain so for a century or so. Sphagnum moss would gradually fill them in, creating a wet, acid soil, and black spruce would become the dominant tree species for a number of centuries, until the layer of peat soil again became high enough, and dry enough, to support poplar and white spruce.

A particular plot of young jack pine, black spruce or other conifer may normally be carrying 20,000 or

30,000, or even 200,000 or 300,000, saplings to the acre, far too many to permit a good growth rate. If the snowshoe hare (bush rabbit) population is high during the sapling stage of these trees, they may be thinned down to the point where growth conditions are good. If the rabbit population remains low, due perhaps to disease or great numbers of lynx or fox, (due perhaps to a trend in fashion and consequent low price for long-haired fur), a particular plot of saplings may not be thinned sufficiently,

and may remain almost static for several decades, too crowded to grow. On the other hand, a plot of jack pine which is thinned too drastically tends to develop heavily branched trees heavily tapered and of little commercial value.

These are a few of the multitude of natural factors which may affect the forest, and they offer some clues to the forester's science, for the forester may replace one or other natural factor to make trees grow according to his desires.

CONCLUSION

Saskatchewan has forests — tremendously worthwhile forests—which will almost certainly provide this province with a \$100 million industry within two or three decades. Nearly three-fifths of Saskatchewan's total area, or 150,000 square miles, is under forest—a vast hinterland of lake and stream, muskeg and rock, broad tree-covered plain and bush meadow. The northern wilderness is of surpassing beauty, a wild lakeland vastness which may one day become a major tourist Mecca and which will remain a breeding ground for fur-bearers and big game animals. In the north also

is a vast piece of the Precambrian Shield, under whose worn, grey igneous rocks are unknown quantities of minerals. But of all these assets the forests are the most important, for they provide the raw products from which ten thousand products in daily use are made, ranging from toothpicks to rayon dresses, from clothespins to the film on which last night's movie was printed, and they provide undiminishing aesthetic attractions.

For the purposes of cash-crop calculations, all Saskatchewan forests may be ignored except the zone aver-

An indication of Saskatchewan's potential for pulpwood production is this stock pile near Armit.



aging 100 miles deep between the agricultural area and the Precambrian Shield. Of this, only the portion south of the 56th parallel is officially considered "commercial forest", since it is the area at present accessible. This 40,000 square mile tract includes poplar, birch, white spruce, black spruce, jack pine, balsam fir and tamarack.

In practical terms, we have at least four distinct areas capable of supporting a 300-ton-per-day pulp mill, or equivalent cellulose production. We have young, easily managed white spruce forests which, over the decades, will mature into timber plentiful enough for a large lumber industry. We have poplar and birch enough that, when properly sawn, the supply of good quality hardwood lumber will be well-nigh inexhaustible.

There are many ways in which this future wealth may be conserved and enhanced. Trees may be planted; great areas of presently unforested land may be scarified and seeded to induce forest regeneration; logging may be done on a selective basis to insure that the over-mature, diseased, crowded, or insect-infested timber is removed, leaving healthy, fast-growing stands; in fact, the science of

forestry provides means and methods which make for a healthy, well-managed forest. But of all management factors, the most vital one is protection from fire. No pulp and paper company would venture the tens of millions of dollars required for such a heavily-capitalized venture unless it felt that the forests on which it depended were fully protected,

There are facilities available which are capable of keeping forest fires under control in normal circumstances. However, abnormal carelessness on the part of lumbermen, campers, prospectors, tourists or forest dwellers can increase the cost of fire fighting and the danger of vast valuable areas being razed.

Saskatchewan citizens are entitled to demand nothing less than adequate forest management on the part of governments and such major companies as may enter the province to utilize the timber. Timber standing in our young forests is money in the bank, money that draws a good interest rate in terms of annual increment. Timber razed by fire or poor logging practice is an indication of tremendous loss of capital—a loss that is directly reflected in the welfare of Saskatchewan's people.

SASKATCHEWAN
Department of Natural Resources

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A mature white spruce stand near Smoothstone Lake.